

Amendment and Response under 37 C.F.R. 1.116

Applicant: Xiang Dai et al.

Serial No.: 10/612,663

Filed: July 2, 2003

Docket No.: 200308566-1

Title: SUPPORTING A CIRCUIT PACKAGE INCLUDING SUBSTRATE HAVING A SOLDER COLUMN ARRAY

IN THE CLAIMS

Please cancel claims 15-16 and 26-27 without prejudice.

Please add claims 30-35.

Please amend claims 8, 10, 14, 21, 23, and 28 as follows:

1-7. (Cancelled)

8. (Currently Amended) An assembled electronic component system comprising:

a printed circuit board;

~~an integrated circuit package, in both a first, initial state of the assembled system and a second, final state of the assembled system, including a substrate and a lid, the substrate having a solder column array connected econnecting the integrated circuit package directly to the printed circuit board and a lid, the lid including an extended portion that extends directly from the substrate outwardly over an edge of the substrate, the integrated circuit package including four corners;~~

a plurality of supports ~~that are separate and distinct from each other, the respective supports~~ disposed directly on the printed circuit board ~~and spaced apart from each other to position with each respective each support~~ disposed at ~~each the respective~~ corners of the integrated circuit package, each support including a body and a pair of wings extending from the body to be substantially perpendicular to each other for contacting the edges of the substrate of the integrated circuit package and the wings of the support being sized and shaped to extend underneath the extended portion of the lid of the integrated circuit package, wherein the body is sized and shaped to extend outwardly in a direction generally opposite from the wings to be exposed relative to, and not in contact with the extended portion of the lid, ~~wherein the wings of the support are sized and shaped to enable a gap between the extended portion of the lid of the integrated circuit package and the wings of the supports in a first initial state of the assembled system, and wherein the wings of the support are sized and shaped to enable contact and vertically support between the extended portion of the lid of the integrated circuit package and the wings of the supports without the gap in a second, final state of the assembled system;~~

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a compressive force mechanism applying a compressive force on the integrated circuit package against the printed circuit board ~~in both the first, initial state of the assembled system and the second, final state of the assembled system~~, with the compressive force translated from the integrated circuit package to the printed circuit board through ~~only the solder column array in the first, initial state of the assembled system and translated from the integrated circuit package to the printed circuit board through both the solder column array of the integrated circuit package and the wings of the supports via the extended portion of the lid of the integrated circuit package in the second, final state of the assembled system~~; and

a heat sink removably secured on top of the lid of the integrated circuit package via the compressive force ~~in both the first initial state of the assembled system and the second, final state of the assembled system~~, the lid of the integrated circuit package being separate from and independent of the heat sink.

9. (Canceled).

10. (Currently Amended) The system of claim 8 wherein the solder column array has a first pre-assembly height in the first initial state of the assembled system and a second post-assembly height in the second, final state of the assembled system, the second post-assembly height being less than the first pre-assembly height.

11-12. (Canceled).

13. (Previously Presented) The system of claim 8 wherein each support includes a detent and the printed circuit board includes a plurality of holes shaped and sized for receiving the detent of the supports so that each support is secured to the printed circuit board upon insertion of the detent of the support into the hole of the printed circuit board.

14. (Currently Amended) The system of claim 8 wherein each support is made from at least one of a plastic material, ~~a metal material~~, and a composite material, with the material having a coefficient of thermal expansion that is substantially the same as a coefficient of thermal expansion of the substrate and the solder column array.

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15-20. (Canceled)

21. (Currently Amended) The system of claim 8 wherein the body of the support is sized, shaped, and positioned relative to the integrated circuit package to be secured relative to the printed circuit board via a fastener extending through the printed circuit board and into the body of the support ~~while the wings of the support are in position below and in contact with the extended portion of the lid of the integrated circuit package.~~

22. (Canceled)

23. (Currently Amended) The system of claim 8 wherein the supports are configured to be mechanically fastened to the printed circuit board without an adhesive and configured to vertically support the lid of the integrated circuit package in the second final state of the assembled system without an adhesive between the extended portion of the lid of the integrated circuit package and the respective supports.

24. (Canceled)

25. (Previously Presented) The system of claim 8, wherein the electronic component system comprises a computer system.

26-27. (Canceled)

28. (Currently Amended) An assembled electronic component system comprising:
a printed circuit board;
an integrated circuit package including a substrate and a lid, the substrate including having a solder column array directly connected connecting the integrated circuit package to the printed circuit board and a lid, the lid including an extended portion that extends outwardly from the substrate over an edge of the substrate, the integrated circuit package including four corners;

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a plurality of supports that are separate and distinct from each other, the respective supports disposed directly on the printed circuit board and spaced apart from each other to position with each respective support disposed at each the respective corners of the integrated circuit package, with each support comprising a pair of wing portions that are generally perpendicular to each other and joined together at one end to define a corner of the respective supports, each wing portion of the respective supports extending underneath the extended portion of the lid of the integrated circuit package between the lid and the printed circuit board, and each wing portion of the respective supports ~~being sized and shaped to leave a gap between the extended portion of the lid of the integrated circuit package and the wing portions of the respective supports in a first initial state of the assembled system, and the wing portions of the respective supports being sized and shaped to contact and vertically~~ support the extended portion of the lid of the integrated circuit package ~~the without the gap in a second, final state of the assembled system;~~

a single band sized and shaped to surround and contact all of the respective supports and apply a lateral force against the wing portions and the corners of the respective supports to removably secure the respective supports in position underneath the extended portion of lid of the integrated circuit package and to maintain the respective supports in position relative to the printed circuit board;

a compressive force mechanism applying a compressive force on the integrated circuit package against the printed circuit board ~~in both the first initial state of the assembled system and the second, final state of the assembled system,~~ with the compressive force translated through only the solder column array ~~in the first initial state of the assembled system and translated through both the solder column array and the wings of the respective supports via the extended portion of the lid of the integrated circuit package in the second, final state of the assembled system;~~ and

a heat sink removably secured on top of the lid of the integrated circuit package via the compressive force with the heat sink being separate from and independent of the lid of the integrated circuit package, ~~wherein the solder column array maintains electrical and mechanical connection between the printed circuit board and the substrate in both the first initial state of the assembled system and the second, final state of the assembled system, and the solder column array has a first height in the first initial state of the assembled system and~~

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~~the solder column array has a second height, less than the first height, in the second, final state of the assembled system.~~

29. (Previously Presented) The system of claim 28, wherein the electronic component system comprises a computer system.

30. (New) The system of claim 28 wherein a height of the wing portions of the respective supports is substantially equal to a creep-induced height of the solder column array.

31. (New) The system of claim 8 wherein a height of the wings of the respective supports is substantially equal to a creep-induced height of the solder column array.

32. (New) An assembled electronic component system comprising:

a printed circuit board;

an integrated circuit package including a substrate and a lid, the substrate having a solder column array connected directly to the printed circuit board and the lid including an extended portion that extends directly from the substrate outwardly over an edge of the substrate, the integrated circuit package including four corners;

a plurality of supports that are separate and distinct from each other, the respective supports disposed directly on the printed circuit board and spaced apart from each other to position each respective support at the respective corners of the integrated circuit package, each support including a pair of wings substantially perpendicular to each other for contacting the edges of the substrate of the integrated circuit package and the wings of the support being sized and shaped to extend underneath the extended portion of the lid of the integrated circuit package to be in contact with, and vertically support, the extended portion of the lid of the integrated circuit package;

a compressive force mechanism applying a compressive force on the integrated circuit package against the printed circuit board, with the compressive force translated from the extended portion of the lid of the integrated circuit package to the printed circuit board through both the solder column array of the integrated circuit package and the wings of the

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supports, wherein a height of the wings of the respective supports is substantially equal to a creep-induced height of the solder column array of the integrated circuit package; and

a heat sink removably secured on top of the lid of the integrated circuit package via the compressive force, the lid of the integrated circuit package being separate from and independent of the heat sink.

33. (New) The system of claim 32 wherein each support is made from at least one of a plastic material and a composite material, with the material having a coefficient of thermal expansion that is substantially the same as a coefficient of thermal expansion of the substrate and the solder column array.

34. (New) The system of claim 32 each support including a body that extends outwardly in a direction generally opposite from the wings to be exposed relative to, and not in contact with the extended portion of the lid, the body of the respective supports being directly secured to the printed circuit board.

35. (New) The system of claim 32 wherein the supports are configured to be mechanically fastened to the printed circuit board without an adhesive and configured to vertically support the lid of the integrated circuit package without an adhesive between the lid of the integrated circuit package and the respective supports.